International Standard 491

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Cinematography — 35 mm motion-picture film and magnetic film — Cutting and perforating dimensions

Cinématographie — Film cinématographique et magnétique de 35 mm *— Dimensions de coupe et de perforation*

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 491 was developed by Technical Committee ISO/TC 36, *Cinematography*.

This third edition was submitted directly to the ISO Council, in accordance with clause 6.11.2 of part 1 of the Directives for the technical work of ISO. It cancels and replaces the second edition (i.e. ISO 491-1978), which had been approved by the member bodies of the following countries :

Australia	Ireland	Sweden
Belgium	Italy	Switzerland
Canada	Mexico	Turkey
Czechoslovakia	Poland	United Kingdom
France	Romania	USA
Germany, F. R.	South Africa, Rep. of	USSR
India	Spain	

No member body had expressed disapproval of the document.

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Cinematography — 35 mm motion-picture film and magnetic film — Cutting and perforating dimensions

1 Scope and field of application

This International Standard specifies the cutting and perforating dimensions for 35 mm unexposed motion-picture film and 35 mm magnetic film, and the types of perforations used.

2 References

ISO 543, *Cinematography — Motion-picture safety film — Definition, testing and marking.*

ISO 554, *Standard atmospheres for conditioning and/or testing — Specifications.*

3 Dimensions

3.1 Measurement made at the time of manufacture shall be taken at a temperature of 23 ± 2 °C as stated in ISO 554. A manufacturer may indicate other nominal temperatures under which dimensions apply.

3.2 The dimensions shall be as shown in the figure and given in tables 1 and 2. They apply to unexposed motion-picture and magnetic films which conform to ISO 543. These specifications apply at the time of cutting and perforating.

3.3 With regard to 35 mm magnetic films, the dimensions which apply are those specified in tables 1 and 2 under the designation "Type P" with a perforation pitch B and the length of any 100 consecutive intervals L.

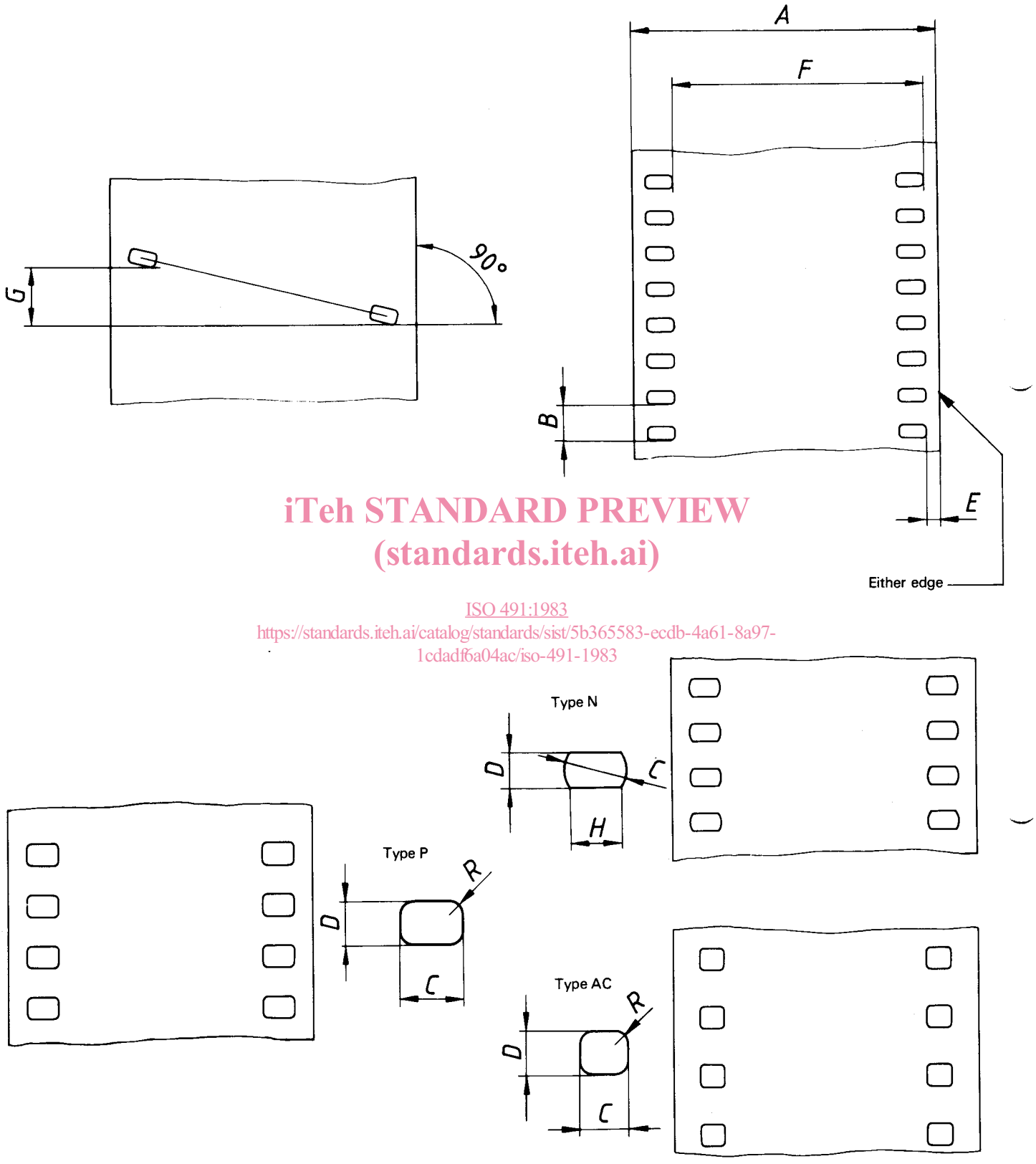

Figure — Types of perforations

Table 1 — Dimensions in millimetres

Dimension	Type P	Type N	Type AC
A	34,975 ± 0,025	34,975 ± 0,025	34,975 ± 0,025
B	4,75 ± 0,01	4,75 ± 0,01	4,75 ± 0,01
B_1	4,74 ± 0,01	4,74 ± 0,01	–
C	$2{,}800\ ^{+\ 0{,}005}_{-\ 0{,}015}$	$2{,}800\ ^{+\ 0{,}005}_{-\ 0{,}015}$	1,98 ± 0,01
D	1,98 ± 0,01	$1{,}850\ ^{+\ 0{,}015}_{-\ 0{,}005}$	$1{,}850\ ^{+\ 0{,}015}_{-\ 0{,}005}$
E	2,01 ± 0,05	2,01 ± 0,05	2,18 ± 0,05
F	28,17 ± 0,05	28,17 ± 0,05	28,63 ± 0,05
G	0,025 max.	0,025 max.	0,025 max.
H	–	2,08 nominal	–
R	$0{,}500\ ^{+\ 0{,}025}_{-\ 0{,}075}$	–	0,330 ± 0,025
L	475,0 ± 0,4	475,0 ± 0,4	475,0 ± 0,4
L_1	474,0 ± 0,4	474,0 ± 0,4	–

Table 2 — Dimensions in inches

Dimension	Type P	Type N	Type AC
A	1.377 ±0.001	1.377 ± 0.001	1.377 ± 0.001
B	0.187 0 ± 0.000 4	0.187 0 ± 0.000 4	0.187 0 ± 0.000 4
B_1	0.186 6 ± 0.000 4	0.186 6 ± 0.000 4	–
C	0.110 0 ± 0.000 4	0.110 0 ± 0.000 4	0.078 0 ± 0.000 4
D	0.078 0 ± 0.000 4	0.073 0 ± 0.000 4	0.073 0 ± 0.000 4
E	0.079 ± 0.002	0.079 ± 0.002	0.086 ± 0.002
F	1.109 ± 0.002	1.109 ± 0.002	1.127 ± 0.002
G	0.001 max.	0.001 max.	0.001 max.
H	–	0.082 nominal	–
R	$0.020\ ^{+\ 0.001}_{-\ 0.003}$	–	0.013 ± 0.001
L	18.700 ± 0.016	18.700 ± 0.016	18.700 ± 0.016
L_1	18.660 ± 0.016	18.660 ± 0.016	–

NOTES

1 While present usage is that type N perforations may be employed for camera and intermediate films and type P perforations for print films, the long-term objective should be for all 35 mm films to have type P perforations.

2 Dimensions L and L_1 represent the length of any 100 consecutive perforation intervals.

3 Dimensions B_1 and L_1 (short perforation pitch) are provided to fulfil the requirements of continuous sprocket contact printing.

Annex

Additional data

(This annex does not form part of the standard.)

A.1 Uniformity of perforations

The dimensions given in this International Standard represent the practice of film manufacturers in that the dimensions and their tolerances are for film stock immediately after perforation. The punches and dies themselves are made to tolerances considerably smaller than those given, but since the film is a plastic material, the dimensions of the slit and perforated film stock never agree exactly with the dimensions of the slitter knives, punches and dies. Film can shrink or swell due to loss or gain in moisture content, or can shrink due to loss of solvent or plasticizer. These changes invariably result in changes in the dimensions during the life of the film. The change is generally uniform throughout a roll.

The uniformity of pitch, hole size and margin (dimensions B, C, D and E) are important variables affecting steadiness. Variations in these dimensions from roll to roll are of little significance compared with variations from one sprocket hole to the next. While no tolerances are specified in the table for this uniformity, it is the maximum variation from one sprocket hole to the next within any small group of consecutive perforations which requires the closest possible control.

A.2 Choice of longitudinal pitch for negative films

The choice of pitch for negative motion-picture films depends, within certain limits, on the type of printer to be used. Where step-printers are used and the film is stationary when exposed, the choice of pitch is not strictly limited. Where the film moves continuously over a cylindrical surface at the time of printing (sprocket-type printer), there are three major considerations involved in choosing the pitch. These considerations are

a) the sprocket diameter;

b) the film thickness;

c) the film shrinkage and the rate at which shrinking occurs.

Maximum steadiness and definition are secured on a sprocket-type printer when the negative stock is somewhat shorter in pitch than the positive stock in the approximate proportion of the thickness of the film to the radius of curvature. For printing on a 64 tooth 35 mm sprocket, which is one with a circumference of about 30 cm (12 in), and with film 0,140 to 0,165 mm (0.005 5 to 0.006 5 in) thick, the optimum pitch differential is 0,3 %. The use of the ideal pitch differential for the negative film would minimize slippage between the positive and negative film during the printing operation, thus reducing the amount of blurring and jumping of horizontal lines in the picture or sound image that otherwise can take place. (This error should be differentiated from the jump caused by non-uniformity of successive pitches B.) Experience has shown that the average pitch L of the negative film can vary by ± 0,1 % from the ideal pitch, which is 0,3 % shorter than that of the positive film, without blurring of picture and sound being easily detected.

For many years, this difference in pitch was caused by the shrinkage of the negative film during processing and ageing. Current film bases shrink less than the earlier ones and hence a shorter initial pitch becomes desirable. To satisfy this requirement for picture- or sound-negatives, it is common manufacturing practice to set the aim for the pitch at a value 0,2 % shorter than that of the positive films on which they will be printed. The additional shrinkage that occurs during processing and the ageing that takes place before the release prints are made then brings the pitch differential close to the optimum and desired value of 0,3 %. Accordingly, the pitch chosen is 4,74 mm (0.186 6 in).

The longitudinal pitch dimensions for the perforation for type N correspond to 0,2 % reduced pitch. Low-shrink negative stock to be perforated to these dimensions should not therefore shrink appreciably more than 0,2 % under normal conditions of use and for a reasonable life span[1] so that the optimum pitch differential from the positive stock of 0,3 ± 0,1 % is maintained.

1) Measured after equilibrium with air at 23 °C (73 °F) nominal temperature and 50 % relative humidity or at the conditions prevailing at the time of perforating.